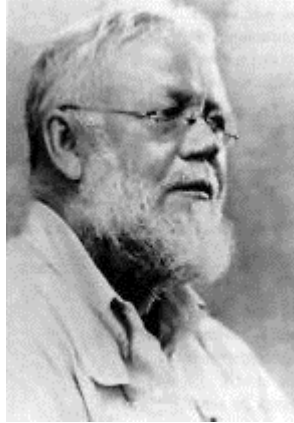


## This Month's Stiff: Professor Reginald Aubrey Fessenden

Entered Mortal coil: 6 October 1866

Assumed Room Temperature: 22 July 1932



### The Prime Modulator

While researching the professor, I realized something mildly humorous about the above photograph. If the periods in time were shifted somehow, Reggie could have entered a Ernest Hemingway look-alike contest. Conducting a Google image search confirmed this observation: the two gentlemen did at least bear a passing resemblance to each other, in my opinion. Note that my original assertion about electrical pioneers in an earlier essay on Hertz still holds true: these guys sported interesting beards. Another distressing observation about inventors and the corporate monster is also true: Fessenden was dogged by lawyers for much of his life. The inventor received a significant settlement in the amount of \$500,000, a tremendous sum in those days. He retired to live on the island of Bermuda, where he subsequently slipped the bonds of this mortal existence.<sup>1</sup> The following quote from the inventor says it all:

*"But despite all my hard work, I lived most of my life near poverty. I fought years of court battles before seeing even a penny from my greatest inventions. And worst of all, I was ridiculed by journalists, businessmen, and even other scientists, for believing that voice could ever be transmitted without using wires...not only was I wealthy from my patents, all of those people who had laughed at my ideas were twisting the dials on their newly bought radios to hear the latest weather and news."*<sup>2</sup>

Fessenden was born in East Bolton, Ontario. Canadians can take pride in one of their own, for it was Reggie who invented the concept of amplitude modulation and actually constructed apparatus to prove his theories. Experimenters at the time were attempting to impress audio on an arc from a spark transmitter, but this proved problematical, to say the least. Fessenden realized that successful telephony via RF (not his initials, by the way) would have to rely on a continuous wave. He understood the concept mathematically. The basic formula for amplitude modulation is:

$$e_c = ( E_{cmax} + e_m ) \sin W_{ct}$$

Where  $e_c$  is the resulting signal being transmitted (carrier + two sidebands),

$E_{cmax}$  is the peak carrier signal without modulation,

and  $e_m$  is the modulating voltage.<sup>3</sup>

Using trigonometry, one can determine that two sidebands, plus and minus, are generated when we modulate a carrier wave with audio.

The most famous demonstration of amplitude modulation took place on Christmas Eve, 1906. Instead of the usual sounds of spark telegraphy, shipboard radio operators were shocked to hear seasonal greetings from Reggie and violin music played by the inventor himself. The radio operators had been alerted to listen for something special that night. Fessenden had successfully transmitted voice earlier in field trials during the process of perfecting his methods a full year before Marconi spanned the Atlantic in 1901. Some cringe at the inventor being labeled “an American Marconi”. Deforest claimed to be the inventor of voice transmission as well, but this is not surprising, given the old rogue's background.



**Ernest Hemingway**

RF (his initials this time) was a prolific inventor, holding over 500 patents. In addition to amplitude modulation, he is credited with the concept of the heterodyne, although his experiments with it did not meet with much success. Other inventions included sonar, the radio compass, and tracer bullets for machine guns. Like Armstrong, it is sad that Reggie did not receive the recognition that was his due, given his great accomplishments.

References:

1. An Unsung Hero: Reginald Fessenden: The Canadian Inventor of Radio Telephony, [http://ewh.ieee.org/reg/7/millennium/radio/radio\\_unsung.html](http://ewh.ieee.org/reg/7/millennium/radio/radio_unsung.html)
2. Raby, Ormond (1970), Radio's first voice. The story of Reginald Fessenden. Toronto: MacMillan of Canada, 1970.
3. Electronic Communications, Roddy and Coolen, 3<sup>rd</sup> Edition, 1984.

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